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THE BRYOLOGIST.

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FURTHER NOTES ON CLADONIAS. IX.

Cladonia squamosa and Cladonia subsquamosa.

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As promised in the last paper of this series (Bry. 9; Nov., 1906) the species to be considered next in order is *Cladonia squamosa.* A somewhat close relationship seems to exist between this species and two of those considered in the last paper, viz *Cladonia caespiticia* and *Cladonia delicata.* When we consider the differences that appear in the horizontal thalli of the three species, we can hardly think that we have a possible immediate genetic line in these species, but the relation is close enough to cause frequent confusion on the part of persons reasonably well acquainted with lichens. If the considerations below and preceding, with the accompanying figures, aid in alleviating the difficulties encountered in the study of these plants, the writer will have accomplished his purpose.

The close relationship between *Cladonia squamosa* and *Cladonia subsquamosa* is generally admitted by lichenists, and the two species are therefore considered in succession in the present paper.

There is still one other difficulty that will be met in the study of *Cladonia squamosa*, and that is confusing certain forms of this species with forms of *Cladonia furcata.* The squamules, both of the primary thallus and the podetia, should furnish sufficient means for differentiation, to say nothing of the podetia, and yet the separation is not always easy to make. As good cladoniologists as Dr. Wainio and L. Scriba failed to agree on a form of *Cladonia furcata* collected by the writer at Fayette, Iowa, Mr. Scriba thinking it might be a form of *C. squamosa* rather than *C. furcata*, but surely all one species, and Dr. Wainio thinking from the material examined that both species were represented in the material sent. Repeated studies at the spot where the plant grows fully convinced the writer that all belonged to the one species, *C. furcata.* A considerable portion of this material is still in the writer's herbarium, and specimens will be sent to any persons sufficiently interested to send for them.

CLADONIA SQUAMOSA (Scop.) Hoffm. Deutschl. Fl. 2: 125. 1796. Primary thallus commonly persistent, composed of middling sized or rarely large, crenate, irregularly-subdigitate or subpinnate-laciniate squamules, which are 1.5–7 mm. long and 1–5 mm. wide; ascending, flat or involute; scattered or clustered and rarely cespitose so as to form a compact crust; sea-green varying toward ashy or brown above, below white; the cortex continuous. Podetia arising from the surface of the primary thallus, rarely dying at the base; 10–85 mm. long and 2–5 mm. in diameter; subcylindrical or rarely trumpet shaped; irregularly turgescent; clustered, erect, ascending, decumbent or irregularly flexuous; rarely simple or commonly more or less irregularly or radiately branched, the branches erect or spreading, the axils fre-

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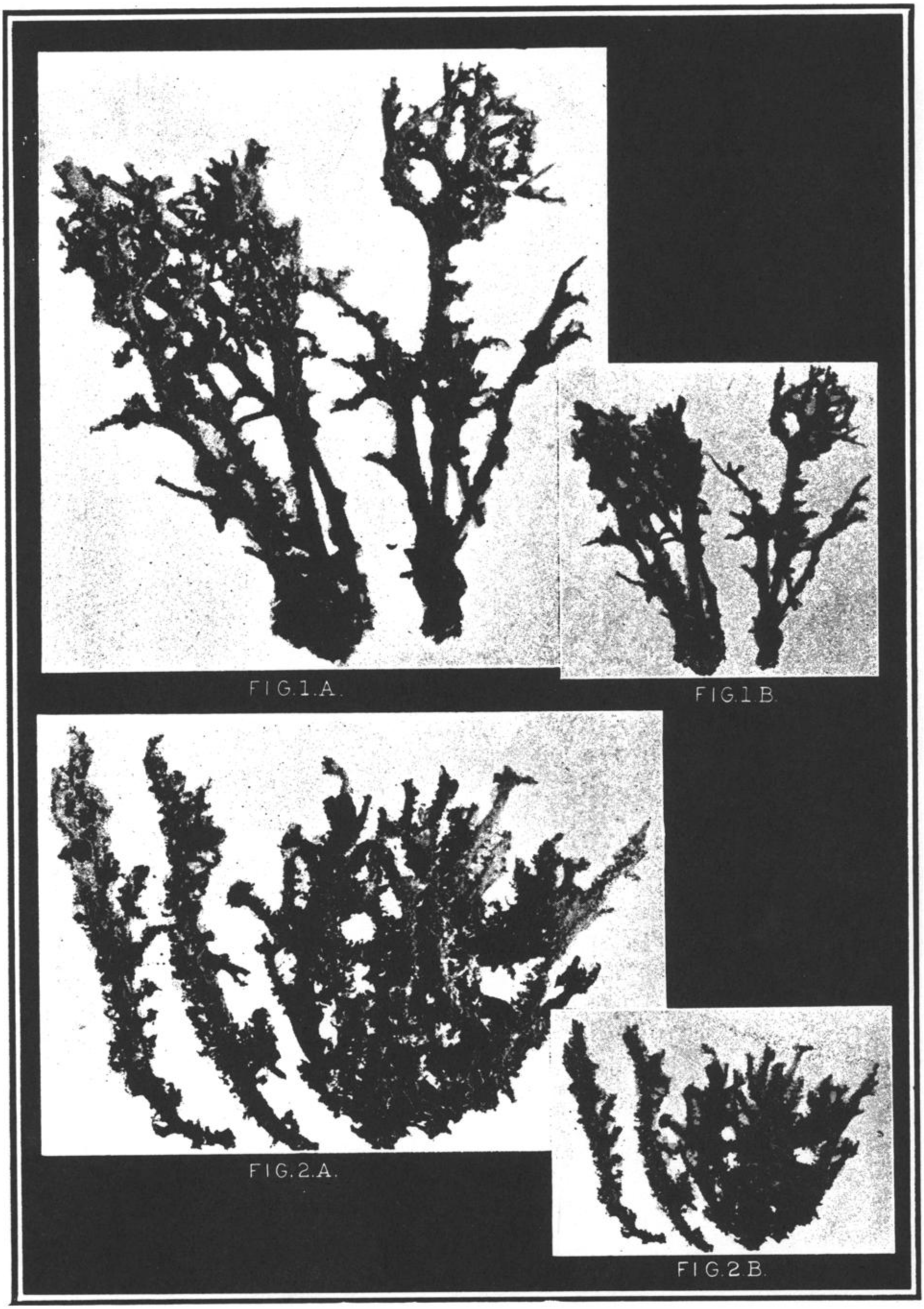

FIG. 1. A.

FIG. 1. B.

FIG. 2. A.

FIG. 2. B.

PLATE IV.—Fig. 1. A *Cladonia squamosa denticollis* f. *squamosissima* × 2. B Natural size.
Fig. 2. A. *C. squamosa phyllocoma* × 2. B Natural size.

quently open: decorticate or sparsely areolate-corticate, or subcontinuous toward the base, the areoles sometimes scattered or entirely disappearing above where the podetia are sometimes sorediate: the corticate portions commonly squamulose with frequently laciniate squamules; ashy, sea-green, olivaceous or brown, or these colors variegated: commonly cup-bearing. Cups abruptly dilated, medium sized or small, usually perforate, the margin commonly repeatedly proliferate. Apothecia small, 0.5–0.7 mm. in diameter; on the margin of the cups or at the ends of branches or proliferations: subsolitary or clustered: thinly margined or immarginate; flat or becoming convex: brown or rarely pale brown or possibly approaching brick-red. Hypothecium pale. Hymenium pale or pale-brownish below and commonly brownish above. Paraphyses usually simple, sometimes thickened and brownish toward the apex. Asci clavate or cylindrico-clavate. Plate IV. Figs. 1. A and B.

On soil, especially humus, or on rocks partly covered with soil, rarely on rotting wood. Grows best in shaded moist places. Examined by the writer from New Bedford, Mass. (H. Willey, who determined as *C. delicata*), Washington (W. W. Calkins, who determined as *C. decorticata*), Newfoundland (A. C. Waghorne), White Mountains (W. G. Farlow), New York (E. A. Burt and Carolyn W. Harris), Ohio (E. E. Bogue), North Carolina (H. A. Green), New Hampshire (Clara E. Cummings and G. K. Merrill), Maine (collector unknown), Missouri (Colton Russell), Nebraska (T. A. Williams), Iowa, Minnesota, Illinois, Ohio, Puget Sound, Alberta and British Columbia (Bruce Fink), Ontario (A. C. Waghorne), Alaska (Wm. Trelease). Listed from Florida by Eckfeldt and Calkins, and Wainio adds Greenland, Vancouver Island, Alabama, and Louisiana. For further wide distribution in British America see John Macoun's "Catalogue of Canadian Plants," part VII. The above gives a general North American distribution, and the plant is also known in all the grand divisions.

The plants listed above, so far seen by the writer, seem to be var. *denticollis* (Hoffm.) Flk., which is common in Europe and America and must stand for the species.

CLADONIA SQUAMOSA MURICELLA (Del.) Wainio Mon. Clad. Univ. 1: 431. 1887. Podetia cupless, commonly almost completely decorticate, sometimes sparsely sorediate, more or less squamulose.

Cited by Wainio from Vancouver Island, and listed from Massachusetts by H. Willey. The writer has seen the variety from Alaska, collected by Wm. Trelease, Known also in Europe, Asia and South America,

CLADONIA SQUAMOSA MULTIBRACTIATA (Flk.) Wainio Mon. Clad. Univ. 1: 437. 1887. Podetia cup-bearing and almost destitute of squamules, corticate.

Determined from Rainy Lake City, northern boundary of Minnesota, by Dr. Wainio. The plants were small, the podetia being 10–25 mm. long and 1–2.5 mm. in diameter, with irregular and proliferate cups. H. Willey regards this the common form at New Bedford, Massachusetts, and the writer has found it in Iowa. Not known elsewhere in North America, and only found elsewhere in Europe.

CLADONIA SQUAMOSA PHYLLOCOMA Rabenh. Clad. Eur. 1860. Podetia cup-bearing subcontinuously or areolate corticate, more or less squamulose. The squamules are said to be rather large, but this is not true of the plant determined by Dr. Wainio from Minnesota and figured herein.

A single collection from Emo, Ontario, along the northern boundary of Minnesota, has been placed here by Dr. Wainio. A European variety, not known elsewhere in North America. Plate IV. Figs. 2. A and B.

CLADONIA SUBSQUAMOSA (Nyl.) Wainio, Mon. Clad. Univ. 1: 445. 1887. Primary thallus composed of middling-sized squamules, which commonly disappear sooner or later. Podetia arising from the surface of the squamules, 12–35 mm. long in ours and becoming twice as long in foreign plants; subcylindrical or tubaeform: sometimes cup-bearing; irregularly branched or rarely simple; axils sometimes perforate: the apices cup-bearing, obtuse and perforate or rarely subulate; erect, the cortex verrucose or areolate or almost wholly decorticate; sometimes squamulose towards the base and squamulose-scaly higher up; whitish-sea-green or varying toward brownish: the base sometimes dying and becoming dark colored. Cups when present perforate, and the margin becoming repeatedly proliferate. Apothecia commonly small, 0.5–0.7 mm. in diameter; subsolitary or more or less aggregated at the apices of the branches; flat and thinly margined or becoming convex and immarginate, brown. Hypothecium pale. Hymenium pale below and brownish above. Paraphyses with thickened apices. Asci clavate. Specimens seen sterile and apothecial characters taken wholly from Dr. Wainio.

A single collection from the same locality as the last variety was placed here by Dr. Wainio. The specimen was collected on earth over rocks. Previously known in North America only from Vancouver Island and Alaska. A rare plant, Dr. Wainio citing a single locality from each of the following grand divisions,—Europe, South America and Australia.

In closing this paper, a word is in order regarding the photographs for illustration. These have been furnished thus far, in part, by Mr. C. J. Hibbard, Dr. E. T. Harper and Mr. G. K. Merrill, and in part by the BRYOLOGIST. The writer spent a summer with Mr. Hibbard photographing lichens, and it was through this connection that Mr. Hibbard was called upon to illustrate the first paper. Since then, Mr. Merrill has furnished the photographs for four papers, Dr. Harper for one and the BRYOLOGIST for the other two. During the session of the University of Washington Marine Station, for the summer of 1906, the writer was with Dr. Harper, who was doing a large amount of photographing of lichens and fungi, and gained his consent to illustrate the remainder of the papers of this series. So we are under obligations to Dr. Harper until the series is finished.

Our illustration of *Cladonia squamosa* is from a specimen sent by L. Scriba of his own collecting in Germany, and named by him *Cladonia squamosa* var. *denticollis*, form *squamosissima* Flk., while that of the var. *phyllocoma* is from the specimen collected by the writer at Emo, and determined by Dr. Wainio.

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